

**Taxonomy, behaviour,
and habitat of *Mesopodagrion* and *Sinocnemis*.
Notes on Old World Megapodagrionidae 3
(Odonata)**

Vincent J. Kalkman

National Museum of Natural History, Naturalis, P.O. Box 9517, 2300 RA Leiden, The Netherlands. <kalkman@naturalis.nnm.nl>

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ABSTRACT

Published records of *Mesopodagrion* are reviewed and the distributions of *M. tibetanum* and *M. yachowensis* are given. *Sinocnemis henanese* is considered a junior synonym of *S. yangbingi*. Based on morphological and behavioural characters *Sinocnemis* is removed from Platycnemididae and placed in Megapodagrionidae. Species of *Sinocnemis* show a general resemblance to species of *Mesopodagrion* but it is not clear if the two genera are closely related. Adults of both *Mesopodagrion* and *Sinocnemis* rest with open wings, and show a preference for perching on horizontal surfaces, keeping their thorax and abdomen close to the surface of their perch. This behaviour may have a thermoregulatory function.

INTRODUCTION

Mesopodagrion tibetanum McLachlan, 1896, the type species of *Mesopodagrion*, was described from Sichuan, China, and placed in Selys' legion *Podagrion* which later became known as family Megapodagrionidae. Chao (1953) described *M. yachowensis* from Sichuan, China, which he later synonymised with *M. tibetanum* (Chao 1987). However, it was recently discovered that *M. yachowensis* constitutes a valid species. A redescription of *M. yachowensis* and a discussion of variability within *M. tibetanum* will be published elsewhere (Yu X., Bu W. pers. comm.).

Sinocnemis was recently described to receive two new species, *S. dumonti* and *S. yangbingi* (Wilson & Zhou 2000). They were placed in Platycnemididae based mainly on their wing venation, although the authors already mentioned that they "do not appear to be closely related to any other member of the Platycnemididae." A third species, *S. henanese*, was described by Wang (2003).

During a trip to Sichuan province in 2005, I observed both *M. tibetanum* and *S. yangbingi*. Since they resembled each other I came to doubt the placement of *Sinocnemis* in Platycnemididae. Here, I provide a key to the species of *Mesopodagrion* and *Sinocnemis*, behaviour and habitat data, and a discussion on the taxonomic position of *Sinocnemis*.

MATERIAL AND METHODS

Because many Chinese place names have undergone various alternative spellings over the last century, the names are given as written on the labels followed by present day names in square brackets when appropriate. Terminology largely follows Watson & O'Farrell (1991). Following acronyms for collections are used:

BMNH — Natural History Museum, London

CUMZ — Cambridge University Museum of Zoology, Cambridge

RMNH — Nationaal Natuurhistorisch Museum Naturalis, Leiden

USNM — U.S. National Museum collection, Washington D.C.

ZMUC — University of Copenhagen, Zoological Museum, Copenhagen

As most previous authors did not distinguish between *Mesopodagrion tibetanum* and *M. yachowensis* I tried to study as many of the published records of *Mesopodagrion* as possible (Table 1), including the holotype of *M. tibetanum* in the BMNH and the holotype of *M. yachowensis* in the USNM (Fig. 1). Specimens of *Mesopodagrion* published by Asahina (1955, 1956) and deposited in ZMUC were not studied but their identity was determined based on illustrations given in the publications.

Information on the male and female of *Sinocnemis benanese* and the male of *S. dumonti* was taken from the original descriptions. The female of the latter species is unknown.

M. tibetanum and *S. yangbingi* were observed at a brook between Yuxian monastery and Xianfeng monastery on Emei Shan Mountain (China, Sichuan) during an hour of sunny weather on 5 July 2005. Additional records of *M. tibetanum* were made during an hour of sunny weather on 7 July 2005 in the direct vicinity of Wolong village (China, Sichuan). A 30 min effort to obtain larvae at this locality was unsuccessful.

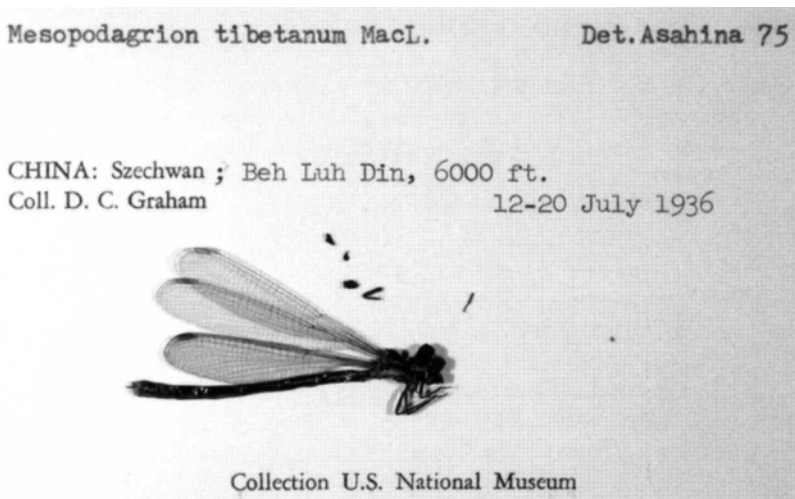


Figure 1: Holotype of *Mesopodagrion yachowensis*, Beh Luh Din, Sichuan province [near Ya'an], China, deposited in USNM.

Table 1. Published records of *Mesopodagrion tibetanum* and *M. yachowensis*. Translation of the locality or additional information on locality is given in square brackets. Except for the records of Chao (1953) which were published as *Mesopodagrion yachowensis* all these records were originally published as *M. tibetanum*.

Location; specimens; date; depository; source

M. tibetanum

China, Yunnan; 5♂; 1918; BMNH, CUMZ; Asahina 1955
 China, Moupin [= present day Paoxing, Sichuan]; 1♂; 1890s; BMNH; McLachlan 1896¹
 China, Mekong valley (26°-29°N), westwards towards the Mekong-Salween divide [Yunnan]; 3♂; unknown²; Morton 1928
 Myanmar, NE Burma [Myanmar], Kambaita, 2,000 m; 5♂, 3♀; 02-11 vi 1934; RMNH (3 ♀ only); Lieftinck 1948
 Myanmar, Upper Burma, Seinghku Valley (28.3°N, 97.3°E), 500-600 m; 2♀; 17 v 1926; BMNH; Asahina 1955
 Thailand, Doi Inthanon, Chiang Mai; 1♂; 11 v 1988; Coll. H. Kurahashi; Asahina 1990³

M. yachowensis

China, Szechwan? [Sichuan?]; 4♂, 1♀; USNM; Asahina 1977
 China, near Chinchu Shien, W of Yachow [= present day Ya'an, Sichuan], 1,500 - 2,000 m; 1♀; 10-11 vii 1930; USNM; Chao 1953, Asahina 1977⁴
 China, Yao-gi, 2,500 m; 1♀; 03 vii 1929; USNM; Asahina 1977
 China, between Li To and Lu Din Chiao, Sichuan; 2♂; 11-14 vii 1930; USNM; Asahina 1977
 China, Beh Luh Din, Sichuan [near Ya'an], 2,000 m; 1♂; 12-20 vi 1936; USNM; Chao 1953, Asahina 1955, 1977⁵
 China, Ho ping tse, South Shensi [= Shaanxi], 1,100 -1,200 m; 1♂, 1♀; 13-15 vi 1936; ZMUC; Asahina 1955
 same; 1♂; 12 vii 1936; ZMUC; Asahina 1955
 China, Siao-Lou, Sichuan; 1♀; 1890s; BMNH; McLachlan 1896⁶
 China, Central China, South Shensi [= Shaanxi]; 3♂; 16 vi and 12 vii 1936; RMNH; Lieftinck 1948
 China, Tien-mu-shan, Chekiang [= Zhejiang], 1,050 m; 1♂, 1♀; 01-03 vii 1937; ZMUC; Asahina 1955, 1956
 China, Tsao Po, Wen Chuan [Sichuan], 1,300 m; 1♂; 03 viii 1938; USNM; Asahina 1977

¹ Holotype of *M. tibetanum*.

² The three males published by Morton (1928) are probably from the same origin as the five males in the BMNH published by Asahina (1955), as they were collected by the same person (G. Forest). The whereabouts of the specimens published by Morton are unknown. As the BMNH specimens belong to *M. tibetanum* it is assumed that Morton's specimens also belong to *M. tibetanum*.

³ The specimen on which Asahina (1990) based the sole Thai record of *M. tibetanum* could not be studied, but based on the distribution of *M. tibetanum* and *M. yachowensis* it was inferred that this record belongs to *M. tibetanum*.

⁴ Paratype of *M. yachowensis*.

⁵ Holotype of *M. yachowensis*. The locality is given as "She Luh Din" by Asahina (1955), as "Deh Lah Din" by Asahina (1977), and as "Beh Luk Din" by Chao (1953).

⁶ Aside from the holotype this is the only other specimen mentioned in the original description of *M. tibetanum*. Study of the specimen showed that it belongs to *M. yachowensis*.

Specimens studied

***Mesopodagrion tibetanum*:** 1 ♂, 1 ♀, Szechuan [Sichuan], Ludwig [?], Mt Gongga [?], 16 vi 1993, leg. Yang Bing, CUMZ; 1 ♂, Deqen Co. [= Deqin, Yunnan], 2,700 m, 06 vi 1994, leg. Yang Bing, RMNH; 2 ♂, 1 ♀, Sichuan, Wolong village, 07 vii 2005, leg. VJK, RMNH; 1 ♂, Sichuan, Emei Shan, brook between the Yuxian temple and Xianfeng temple, 1,400-1,600 m, 05 vii 2005, leg. VJK, RMNH; 1 ♂, Ta-tsien Lou [= present day Kangding, Sichuan], 1893, leg. "chasseurs indigenes", RMNH.

***Mesopodagrion yachowensis*:** 1 ♂, South Shensi [= Shaanxi], 16 vi 1936, leg. E. Suen-son, CUMZ; 1 ♂, same, BMNH; 1 ♂, same, 13 vii 1936, CUMZ; 5 ♂, 2 ♀, same, 14-20 vi 1936, USNM; 1 ♂, 2 ♀, same, 12-14 vii 1936, USNM; 1 ♂, 6 ♀, Chekiang province [= Zhejiang], T'ien-mu-shan, vi-vii 1936, leg. unknown, USNM; 2 ♂, Shensi, Han Wu Tai near Sianfu in Tainliag [Shaanxi], 28 vi 1936, leg. H. Höne, RMNH.

***Sinocnemis yangbingi*:** 3 ♂, 3 ♀, Sichuan, Emeishan, 10 vi 1992, leg. Yang Bing, BMNH, same locality and date as the types; in original description incorrectly given as 6 x 1992; 1 ♂, 1 ♀, same, 10 vi 1992, RMNH; 8 ♂, 3 ♀, same, 08/09 vi 1992, CUMZ; 1 ♂, 1 ♀, Sichuan, Emei Shan, brook between the Yuxian temple and Xi-anfeng temple, 1,400-1,600 m, 05 vii 2005, leg. VJK, RMNH.

RESULTS

Key to the species of *Mesopodagrion* and *Sinocnemis*

1. Wings broad with 3-4 cells distally between IR2 and R3. Male paraproct less than half as long as cercus. Medial part of posterior rim of S10 drawn out and ending in two small posteriorly directed projections. Genital ligula as in Figures 2a-d with terminal lobe reduced, deeply incised, and with two long and slender horns; its shaft with less than 10 setae on each side which are shorter than half the width of the shaft *Mesopodagrion* 2

1'. Wings slender with 2 cells distally between IR2 and R3. Male paraproct more than half as long as cercus. Posterior rim of S10 not drawn out and lacking apically directed projections. Genital ligula as in Figures 2e-f (*S. yangbingi*) with a terminal lobe, which is not or only slightly incised and which has no apical horns (*S. yangbingi*) or only short ones (*S. dumonti*); its shaft with more than 20 setae on each side which are clearly longer than half the width of the shaft *Sinocnemis* 3

2. Hind margin of head yellow along occiput and largely black between postocular lobes; stripe on mesepisternum not crossing mesopleural suture. Male inner margin of basal half of cercus proximal to its bent straight. Horns of genital ligula in ventral view (Fig. 2a) less slender and bent laterally; in lateral view apices pointing ventrally (Fig. 2b) *M. tibetanum*

2'. Hind margin of head yellow between occipital lobes and black along border of occiput; stripe on mesepisternum crossing mesopleural suture and continuing on mesepimeron. Male inner margin of basal half of cercus proximal to its bent convex. Horns of genital ligula in ventral view (Fig. 2c) with a more slender base and evenly curved; in lateral view apices pointing posteriorly (Fig. 2d) *M. yachowensis*

3. Male dorsum of S8-10 blue. Apical corners of terminal lobe of genital ligula rounded (Figs 2e, f). Female dorsum of S8-10 largely blue *S. yangbingi*
- 3'. Male dorsum of S8-10 black. Apical corners of terminal lobe of genital ligula drawn out and forming short, laterally projected horns. Female unknown but S8-10 possibly black as in male *S. dumonti*

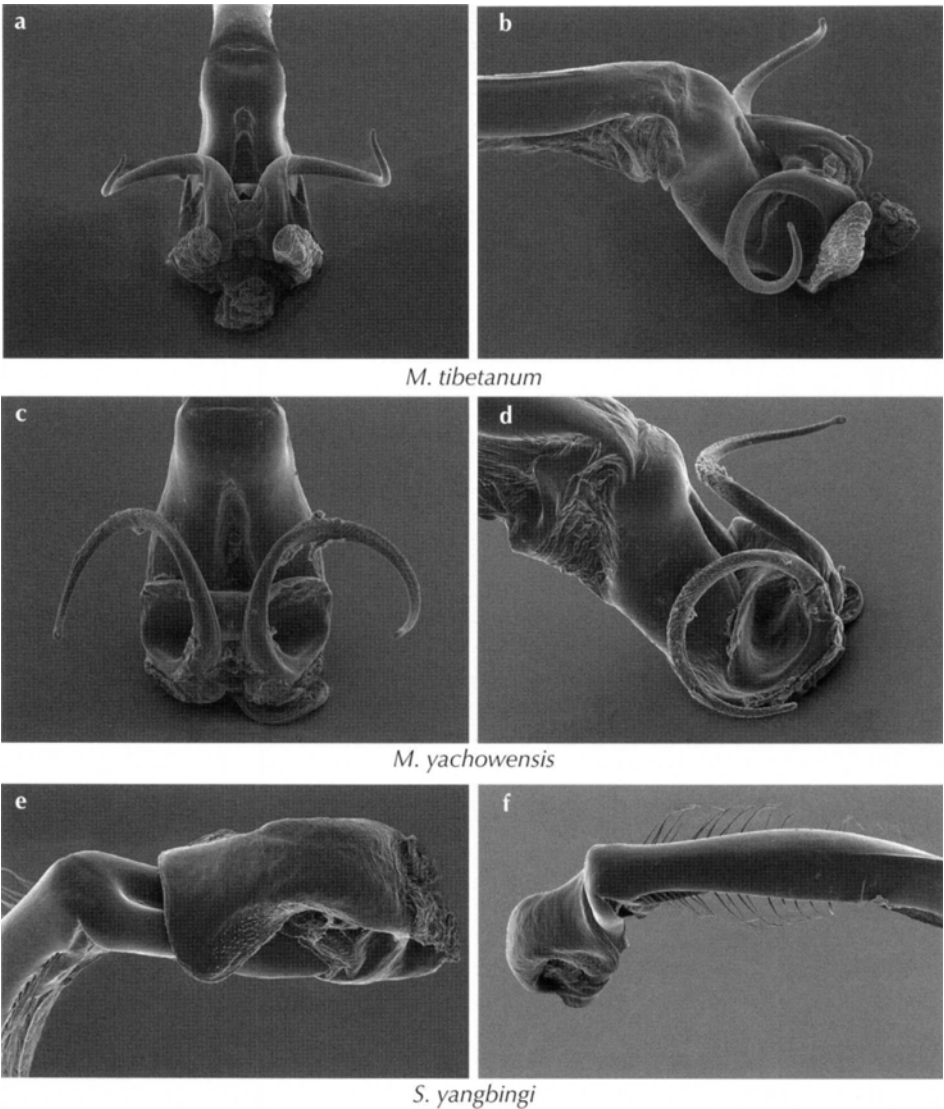


Figure 2: SEM photographs of the genital ligula of *Mesopodagrion* and *Sinocnemis* species — (a) *M. tibetanum*, China, Emeishan, ventral view; (b) same, lateral view; (c) *M. yachowensis*, China, South Shaanxi, ventral view; (d) same, lateral view; (e) *S. yangbingi*, China, Emeishan, latero-ventral view; (f) same, long setae on the genital ligula shaft. Photos: Dirk Gassmann.

Observations on habitat and behaviour

At Emei Shan (Sichuan province) I observed one male of *M. tibetanum* and one male and one female of *S. yangbingi* along a small path bordering a larger, at least partly sunny, rocky stream at 1,400-1,600 m. They co-occurred with *Megalestes* sp., and it was not clear if this stream or if the nearby runnels served as larval habitat. At Wolong (Sichuan province) two males and one female of *M. tibetanum* were seen along a partly channelized, stony brook less than 1 m wide and 40 cm deep. This largely unshaded brook flowed through agricultural fields. All specimens of both *M. tibetanum* and *S. yangbingi* perched with wings open and legs outstretched, holding their thorax and abdomen close to the surface of stones and leaves on which they were sitting (Plates I, II). I disturbed a male of *M. tibetanum* ca ten times, and it landed on a twig only once, showing a clear preference to land on horizontal surfaces.

DISCUSSION

Status of *Sinocnemis henanese*

The original description of *S. henanese* (Wang 2003) mentions four characters diagnosing it from *S. yangbingi*:

(1) pronotum of male and female with two yellowish rounded spots; (2) terminal margin of distal segment of genital ligula with an apophysis; (3) lateral margin of S3 and S4 with a long longitudinal yellowish stripe; (4) upper posterior corner of mesepimeron without a pale stripe.

S. yangbingi also has rounded spots on pronotum (Plate II), yellow in female and bluish in male, and these spots are probably yellowish in immature males. I was unable to discern the second character from the drawings of the genital ligula of *S. henanese*, as they do not show any clearly definable differences with illustrations of *S. yangbingi* given in Wilson & Zhou (2000). The apex of the penis of *S. yangbingi* has a soft and probably inflatable area. I suggest a similar condition exists for other species of *Sinocnemis*, rendering this character diagnostically unreliable. The long longitudinal stripes along lateral margin of S3 and S4 are also present in *S. yangbingi* (Plate II) and do not constitute a good diagnostic character. The absence of a pale stripe on the upper posterior corner of mesepimeron constitutes therefore the only valid diagnostic character. I consider however that it is a very feeble base on which to distinguish two species. A more complete description might show *S. henanese* to be a valid species, but for the time being I consider the name *henanese* a junior synonym of *yangbingi*.

The name *henanese* as proposed by Wang (2003) refers to the province of Henan as the type locality. However, since the original description does not explicitly state that the author intended to form and treat the species name as an adjectival form of Henan, in which case its latinization would be '*henanensis*', the name should be interpreted as an "arbitrary combination of letters" (ICZN Art. 11.3) and treated as a non-Latin noun in apposition, which retains its original spelling.

Placement of *Sinocnemis* in Megapodagrionidae

Wilson & Zhou (2000) gave no rationale for placing *Sinocnemis* within Platycnemididae. Their acknowledgment that “the two new platycnemidid species described here do not appear to be closely related to any other member of the Platycnemididae” indicates that the authors had some doubts. They characterised *Sinocnemis* based on three characters:

- (1) R4+5 arising at a point distinctly proximal to the level of nodus
- (2) Presence of intercalated sectors cells located between IR2 and IR3
- (3) IR2 arising closer to nodus than to pterostigma

Characters (2) and (3) are not known for any platycnemidid, while character (1) is more pronounced in *Sinocnemis* than in any platycnemidid. Besides, three of the five diagnostic characters for Platycnemididae given by Martens (1996) and Gassmann (2005) are not present in this genus:

- Discoidal cell (quadrilateral) obtuse (pointed in *Sinocnemis*)
- Pt not longer than one underlying cell (as long as two cells in *Sinocnemis*)
- Longitudinal veins MA and IR3 straight to almost the end (with apical third zigzagged in *Sinocnemis*)

In addition, in *S. yangbingi* there is a lateral row of long setae along sides of genital ligula shaft (Fig. 2f), a character absent in most Platycnemididae (Gassmann 2005, D. Gassmann pers. comm.) but present in all Oriental megapodagrionid genera except *Podolestes* (VJK unpubl.). *S. yangbingi* keeps its wings open at rest, a habit not shown by any platycnemidid but the normal situation for all but a few megapodagrionids. Therefore, I conclude that *Sinocnemis* is more closely related to genera now assigned to Megapodagrionidae. The family Megapodagrionidae is difficult to define as it is likely to be polyphyletic. However 21 of the 24 Old World genera of megapodagrionids – *Calilestes* Fraser, 1926 and *Lestomima* May, 1933 are considered synonyms of *Rhipidolestes* Ris, 1912 (Pseudolestidae) (VJK; K. Wilson unpubl.) – can be recognised as such based on the following characters:

- (1) Two or sometimes three antenodals
- (2) Discoidal cell (quadrilateral) with an acute distal angle and anterior border clearly shorter than posterior border
- (3) R4 and IR3 originating well beyond halfway from arculus to level of subnodus
- (4) Pt clearly longer than wide and with an acute proximal end
- (5) At least two but often more rows of cells at distal end of fields between IR2, R3, IR3, R4, and MA

Three Old World megapodagrionid genera not fitting this description are *Tatocnemis* Kirby, 1889, *Protolestes* Förster, 1889, and *Amanipodagrion* Pinhey, 1962. The first two are Madagascar endemics which lack intercalated veins at wing tip (character 5). The third, *Amanipodagrion*, lacks intercalated veins and has a discoidal cell in which anterior border is about as long as posterior border. This monotypic genus is atypical in other respects also, as it is one of the few Megapodagrionidae which perches hanging instead of sitting (see Clausnitzer 2003: fig. 2) –

shared with New World *Mesagrion* Selys, 1885 and *Thaumatoneura* McLachlan, 1897 (N. von Ellenrieder pers. comm.) – and has black banded wings – shared with New World *Paraphlebia* Selys, 1862 and *Thaumatoneura*. The black banded wings and resting position do remind of African Synlestidae.

The five characters mentioned above are all present in *Sinocnemis* and their combination is unique for Megapodagrionidae. *Mesopodagrion* and *Sinocnemis* show a close resemblance in general appearance. Both are relatively large with a bulky head, have similar wing venation, and face and abdomen patterned with black and blue; they are diagnosed in the key above.

Distribution, habitat, and behaviour

Mesopodagrion tibetanum is known from the Chinese provinces of Yunnan and Sichuan and from NE Burma. The record of a *Mesopodagrion* from Thailand (Asahina, 1990) likely corresponds to this species, as *M. yachowensis* is a Chinese endemic with a more northerly distribution. *M. yachowensis* overlaps with *M. tibetanum* in Sichuan and is also known from the provinces of Shaanxi and Zhejiang. Both are confined to mountains with *M. tibetanum* not found below 1,050 m and *M. yachowensis* not below 1,400 m. *S. dumonti* is only known from Xishui reserve in Guizhou, China, and *S. yangbingi* from Emeishan and Henan (types of *S. henanese*), China.

My observations suggest that unlike most Oriental species of Megapodagrionidae which occur in dense forest, these two genera occur in more open habitats. *M. tibetanum* is tolerant of the altered habitat at Wolong, showing that this species is able to cope with human influence. This, combined with its wide distribution, makes it likely that *M. tibetanum* is not threatened.

The perching behaviour described here for *Mesopodagrion* and *Sinocnemis*, settling flat against a reflecting surface, may serve a thermoregulatory role as has been suggested for Petaluridae, Aeshnidae, Corduliidae, and Libellulidae (Corbet 1999: 285-291) but it is far less commonly known in Zygoptera. Most genera of Megapodagrionidae are limited to tropical areas. The behaviour of *Mesopodagrion* and *Sinocnemis* might be an adaptation which enabled them to penetrate into temperate regions. Their relatively sturdy build might be another adaptation to relatively cold circumstances as was suggested also for the coenagrionid genus *Oreagrion* (Ris) by Lieftinck (1959).

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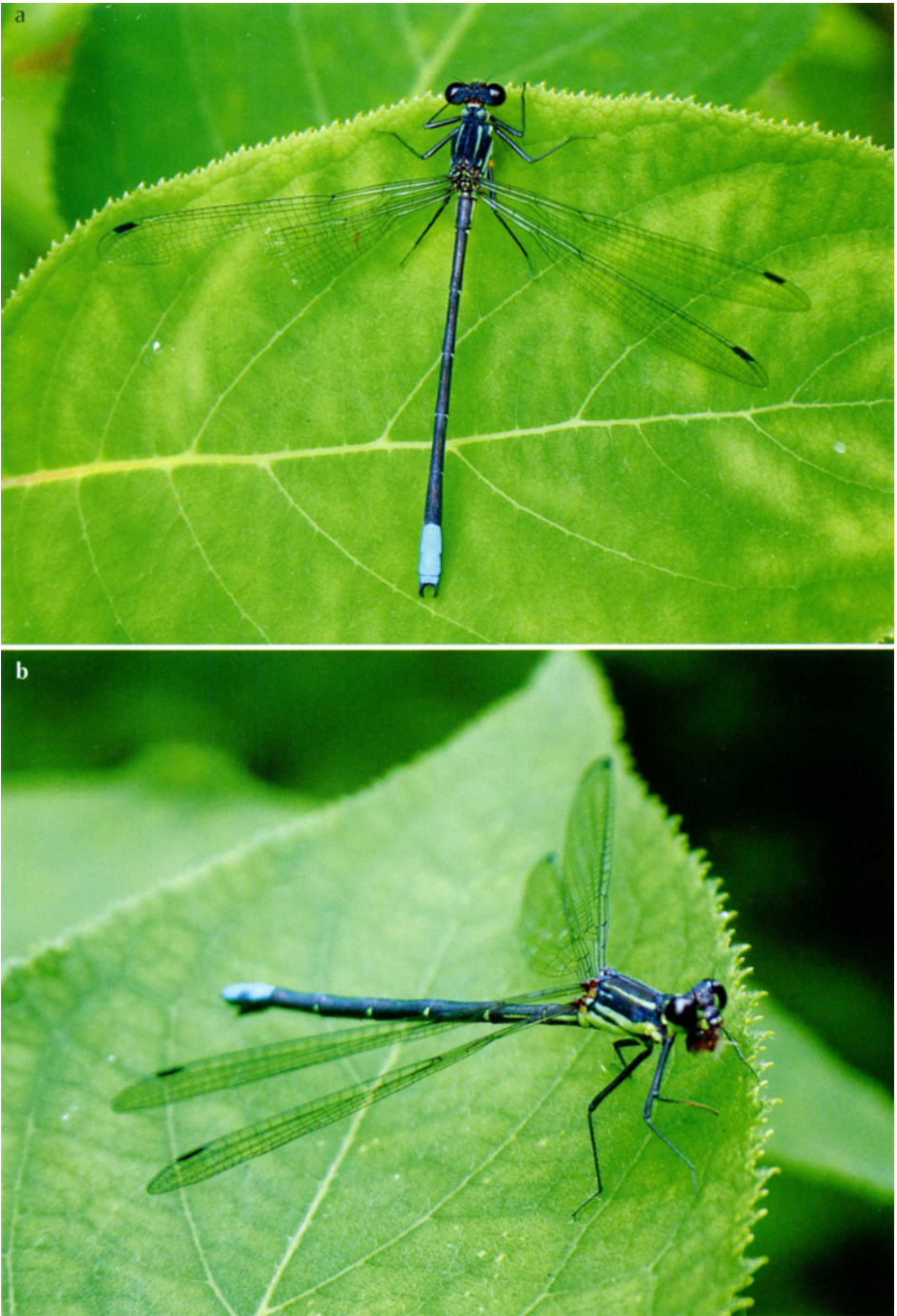
I thank Xin Yu for information on his work on *Mesopodagrion*, Keith Wilson for providing me with some references, and Graham Reels for translating parts of Wang (2003). Natalia von Ellenrieder, Rosser Garrison, Dirk Gassmann and Jan van Tol commented on the manuscript.

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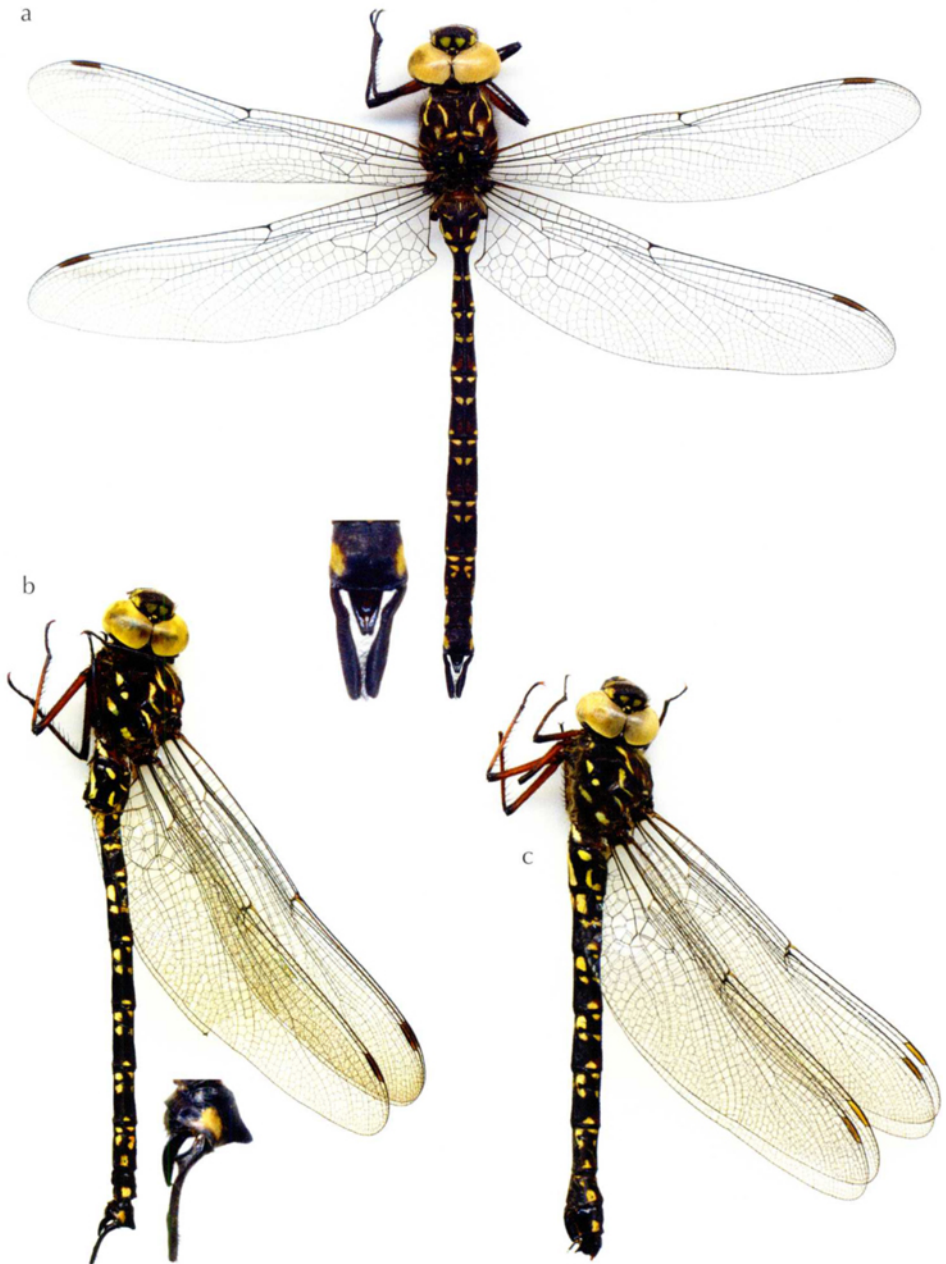
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Colour plate I: *Mesopodagrion tibetanum*, Wolong, Sichuan, China, 7 July 2005 — (a) male; (b) female. Photos by Vincent Kalkman.



Colour plate II: *Sinocnemis yangbingi*, Emei Shan, Sichuan, China, 5 July 2005 — (a) male; (b) female. Photos by Vincent Kalkman.



Colour plate III: *Austroaeschna ingrid* sp. nov. — (a, b) paratype male and inserts of enlarged anal appendages, dorsal and lateral; (c) paratype female, lateral.



Colour plate IV: Males of two *Oligoclada* species in Argentina — (a) *O. laetitia* at oxbow pond of Bermejo River, at Reserva Natural Formosa, 15 February 2008; (b) *O. rubribasalis* sp. nov. at marsh next to Laguna Blanca, Parque Nacional Río Pilcomayo, Formosa, 16 February 2008; (c) *O. laetitia* perching in the obelisk position on pond's bank at Reserva Natural Formosa, 15 February 2008. Photos by Rosser Garrison (a, b) and Natalia von Ellenrieder (c).